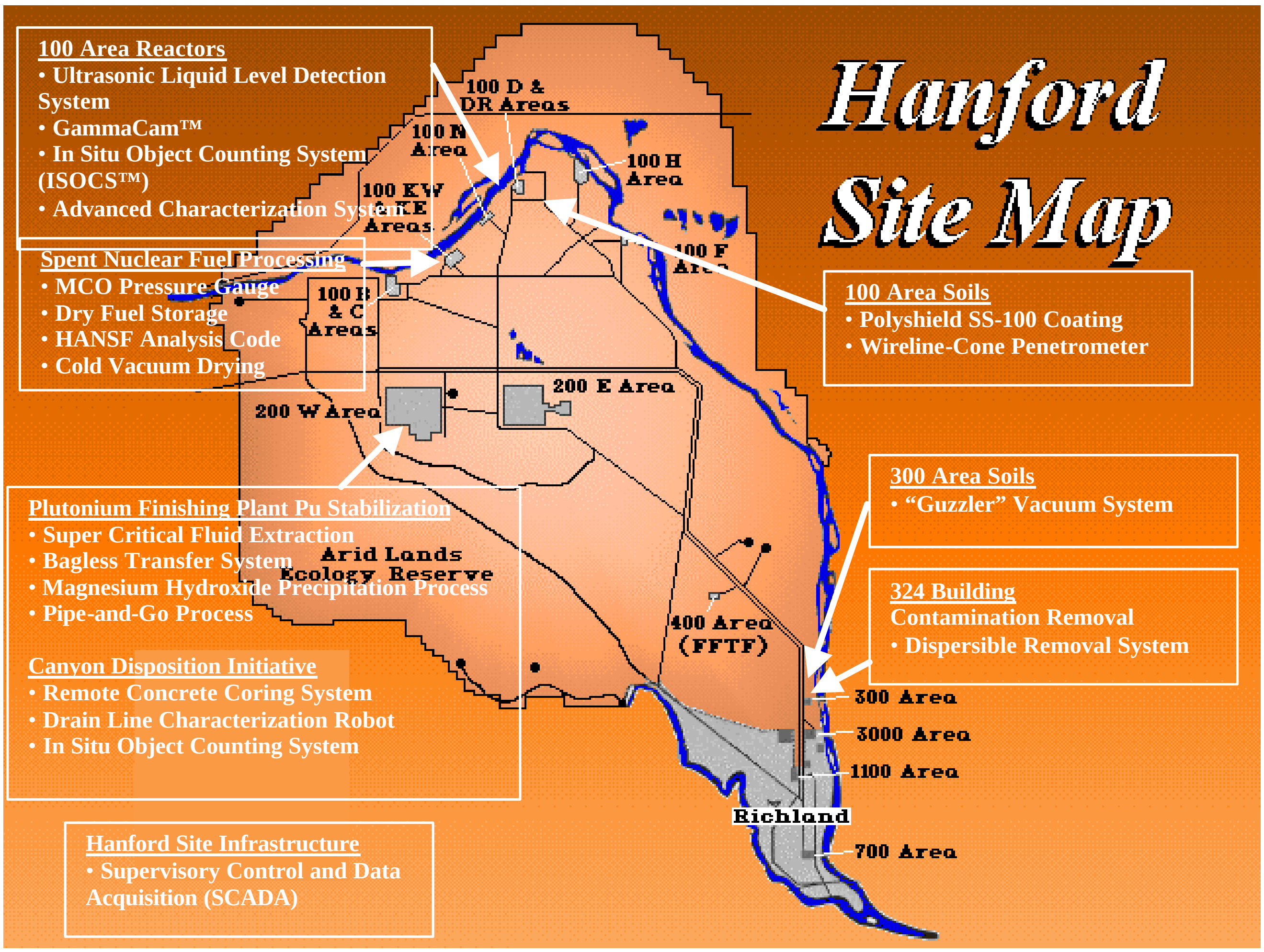
Significant S&T Activities at Richland Operations Office, March 2001



Hanford Site Infrastructure

Hanford Site Electrical Power Distribution System Upgrade
State-of-the-art hardware and software were needed to upgrade the electrical power distribution system on the Hanford Site. **Supervisory Control and Data Acquisition (SCADA)** is a computer hardware and software system that allows for remote operation of electrical power substations. It replaced a system that was difficult and expensive to maintain due to components that are antiquated or no longer available. The current software requires minimum hardware maintenance and the software does not require a high level programming language. Implementation of the new technology will reduce the risk of system failures and reduce maintenance costs. [Deployed June 2000]. [Tech ID 8084]

100 Area Reactors

Between 1942 and 1955, eight water-cooled, graphite-moderated production reactors were constructed along the Columbia River in the 100 Areas of the Hanford Site. The Reactors Interim Safe Storage Project is decontaminating and decommissioning the reactor facilities and placing the reactor cores into interim safe storage. The new smaller, safer facility will shield the reactor's core from the environment for up to 75 years or until final disposition. The following technologies were recently deployed under this project.

Examine Piping for Presence of Liquids
The **Ultrasonic Liquid Level Detection System** was deployed on the Reactor Interim Safe Storage Project to assay selected piping for the presence of liquid. The system uses ultrasonic/acoustic wave transmission to non-invasively determine the liquid level inside pipes. Non-invasively detecting liquids in pipes eliminates the need to physically open and inspect these pipes. Risks to workers associated with gaining access to the pipes and the possible exposure to radioactive or contaminated contents can nearly be eliminated. [Deployed in February 2001]. [Tech ID – INDP – 2403]

Characterize F Reactor Fuel Storage Basin
The Advanced Characterization System (ACS) was deployed to characterize the F Reactor Fuel Storage Basin (FSB). The ACS deployment included the following technologies:

The **GammaCam™** provides a pseudo-color image of gamma-ray radiation fields superimposed on a black-and-white visual image of the target. The recently developed GammaModeler™ system displays results as combined 3-D representations of the radiation sources and the environment. The GammaCam™ provides a means to remotely locate high-intensity gamma radiation sources buried in the F Reactor FSB. Accurate dose assessments performed from a distance are advantageous from an ALARA perspective. [Deployed in February 2001]. [Tech ID – DDFA – 1840]

The **In Situ Object Counting System (ISOCS™)** is a portable in situ Germanium-based spectrometry system that is designed to provide information on types and amounts of radioactive material. It will allow "fingerprinting" to identify irradiated fuel pieces in the F Reactor FSB prior to excavation. This capability is valuable in addressing ALARA concerns, and in supporting project planning for packing, transporting, and processing materials as they are excavated. [Deployed in February 2001]. [Tech ID – DDFA - 2098]

Characterize Reactor Building Concrete
Tens of thousands of tons of concrete exist in surplus Hanford Site facilities scheduled for demolition. The concrete is currently surveyed for external contamination, sampled and analyzed for specific radionuclides and their activities, and then typically shipped as low-level waste. Much of this concrete is well below volumetric contamination criteria. The only method currently in use within the Environmental Restoration (ER) Project for determining volumetric contamination is via coring and sampling. The coring and sampling process generates

waste, is manpower intensive, and requires expensive laboratory analysis. The **Advanced Characterization System** (ACS) was deployed on the D Reactor Interim Safe Storage Project to characterize and free-release portions of the D Reactor building concrete. Deploying the ACS provided cost savings by reducing waste from decontamination and decommissioning (D&D) activities, the number of samples required for characterization prior to D&D, and the manpower needed to perform radiological characterization. [Deployed in June 2000]. {Tech ID 8097]

100 Area K Basins Spent Nuclear Fuel Project

The Spent Nuclear Fuel Project is challenged with moving more than 2,300 tons of spent fuel, sludge, debris, and contaminate water away from the Columbia River to interim dry storage. The irradiated nuclear fuel has been stored in basins located 1,500 feet from the rivers. The following technologies were recently deployed under this project.

Spent Fuel Canisters Monitoring System
Spent nuclear fuel is removed from the basins and placed in specially designed containers (multi-canister overpacks-MCOs). The fuel is then dried and the canisters are sealed for long-term dry storage. The technical challenge recently addressed at Hanford is the monitoring of MCOs for potential pressure buildup. A non-intrusive pressure monitoring **(MCO Pressure Gauge)** was designed for placement in the MCO. The innovative device uses a standard mechanical pressure gauge and magnet assembly linked to an exterior needle. A series of gears link the magnet with the sensor such that an increase in pressure results in a rotation of the magnet. Magnet rotations are shown on a compass-like magnetized needle gauge mounted on the cap of the MCO. [Deployed in December, 2000] [Tech ID 8740]

Dry Storage of Spent Nuclear Fuel
The 2,100 metric tons of spent nuclear fuel will be dried and sealed in approximately 400 MCOs. The MCOs will be stored in tubes at the Canister Storage Building (CSB) on the Hanford central plateau. Use of **Dry Fuel Storage** technology creates a significant operational cost savings over wet (basin) storage techniques. These savings are derived from greatly reduced operating costs, as the dry storage configuration relies on passive convective cooling instead of active water-cooling systems. The risk is reduced by storing fuel in a dry inert environment that prevents fuel corrosion from uranium-water reactions. [Deployed in December, 2000] [Tech ID 8739]

Technical Baseline Calculations for Spent Fuel Packaging and Storage
HANSF (for Hanford Spent Fuel) is a computer code developed and validated to model the complex heat transfer mechanisms and chemical reactions within Multi Canister Overpacks (MCOs), the containers built to contain the spent nuclear fuel during interim dry storage. The integrated model considers a wide variety of phenomena inside the MCO and provides the technical basis for the safety analysis that allows higher fuel density packing in the MCO. [Deployed in July 2000]. [Tech ID 8099]

Drying Spent Nuclear Fuel
The **Cold Vacuum Drying (CVD)** Facility and its drying operation represent a one-of-a-kind, first-of-a-kind structure. After spent nuclear fuel has been removed from K East and K West basins and placed in MCOs, the fuel is dried in the CVD facility and prepared for safe storage and surveillance in the Canister Storage Building. This process is able to dry large quantities (5-6 tons) of fuel per batch. [Deployed in September 2000]. [Tech ID 8079]

100 Area Soils

116-N-3 Crib Remediation

While excavating soil and engineered structures in the 116-N-3 Crib, smearable contamination on the outside of the massive concrete distribution trough was discovered. This was a concern because the work plan called for cutting this trough into sections with a wire saw, and the presence of loose contamination presented an air release concern. Any number of fixative coatings could have been employed in temperate weather, but very cold conditions in December required a coating that could be applied in below-freezing temperatures. The **Polyshield SS-100 Coating** was the coating chosen to fix the contamination. The ability to apply this material in any type of weather, especially in cold weather, provided the greatest benefit to the project. Securely fixing contamination on the outside of the distribution trench greatly reduced the chances of contamination spreading during demolition and rigging activities. [Deployed in December 2000]. [Tech ID 8728]

126-F-1 Ash Pit Site Characterization

Information on the presence and amount of radionuclide contamination in the subsurface is needed for soil cleanup throughout the Hanford site. Determination of subsurface contamination is most commonly conducted by drilling conventional (e.g., 8" diameter) boreholes and logging them with industry-standard geophysical probes or collecting sediment samples during drilling operations. One innovative technology was deployed in June 2000 to characterize subsurface soils at the 126-F-1 Ash Pit:

The **Wireline-Cone Penetrometer System** (Wireline-CPT) allows multiple CPT tools to be interchanged during a single penetration, without withdrawing the CPT rod string from the ground. This innovation reduces the time required to take samples or deploy sensors in the subsurface. The Wireline-CPT system was also used at the Vadose Zone Test Site in the 200 Area. Cost estimates suggest that the Wireline-CPT system reduces the cost of site characterization by up to 75%. [Deployed in July 2000].

200 Area Plutonium Finishing Plant

The Plutonium Finishing Plant was the final link in Hanford's plutonium production activities. The plutonium finishing plant is currently stabilizing 17.8 metric tons of bulk plutonium-bearing materials left from the defense production.

Moisture Measurement of Stabilized Plutonium

A new analytical technique using **Supercritical Fluid Extraction Moisture Measurement** technology was recently deployed to accurately determine the moisture content of impure plutonium compounds prior to placing the material in plutonium canisters for long-term storage. The method, which meets DOE standards for long-term storage was installed in a process glove box at the Hanford Plutonium Finishing Plant, thus eliminating the need to transport samples to a laboratory. This technique replaces the loss-on-ignition test that has provided false positive indications of high moisture content due to volatilization of non-moisture components. This technology has reduced the recycle of materials that appear to fail the loss-on-ignition method. [Deployed in October, 2000]. [Tech ID 3002]

Stabilization of Plutonium Solutions

A process was needed to stabilize plutonium solutions generated from previous processing campaigns at the Plutonium Finishing Plant (PFP). The **magnesium hydroxide precipitation process**, which has been used at the Rocky Flats Environmental Test Site (RFETS) to treat low-level plutonium solutions for disposal, was adapted with assistance from the Pacific Northwest National Laboratory, Los Alamos National Laboratory and RFETS to treat more concentrated plutonium solutions at Hanford. The process converts plutonium in solution to insoluble plutonium hydroxide that is then thermally stabilized and placed into long-term storage containers that meet DOE Standard 3013-99. [Deployed in September 2000]. [Tech ID 8094]

Packaging Stabilized Plutonium-Bearing Special Nuclear Material
The Plutonium Finishing Plant has the challenge to safely stabilize and provide long-term packaging for plutonium-bearing special nuclear material by 2004. The **Bagless Transfer System** provides the equipment to remotely weld containers meeting the DOE Standard 3013-99 specifications for long-term storage of plutonium. This system is a proven technology currently being used at the Savannah River Site, and provides cost savings and less technical complexity as compared to the baseline system that was under development. [Deployed in September 2000]. [Tech ID 1932]

Disposal of Plutonium Residues
Plutonium residues associated with previous processing campaigns at PFP have been stored in vaults awaiting stabilization or disposal. The **Pipe-and-Go** process has been deployed at PFP to prepare plutonium residues for shipment offsite to the Waste Isolation Pilot Plant. The new process eliminates the need for blending ash with cement before packaging. Residues are simply placed into slip lid cans which are placed into a pipe overpacks in a standard Department of Transportation 55-gallon drum. The packaging process and regulatory path to success were based on the experience at RFETS. Deployment of this simple, proven technology reduces program risk and radiation exposure to workers associated with the baseline cementation process. [Deployed in September 2000]. [Tech ID 8080]

200 Area Canyon Disposition Initiative

The Canyon Disposition Initiative (CDI) Project is a collaborative project which includes participation across the programs of the U.S. Department of Energy (DOE) Office of Environmental Management, as the decisions made will have broad and significant impact to all programs. The purpose of the CDI Project is to establish an end-state for the five Hanford processing canyons, and potentially for other canyons and canyon-like facilities across the DOE complex. The 221-U Facility at the Hanford Site is the pilot for the CDI. The following technologies were recently deployed under this project.

Characterize Subterranean Drain Pipe
Characterization requirements for the 221-U Facility drain line included 1) a visual record for assessment of the structural integrity of the pipe and from where liquid may be draining, 2) a scale or sludge sample to obtain the isotopic distribution of radiological contaminants of potential concern (COPC) and the inventory of nonradiological COPCs, and 3) a radiological survey of the pipe using gamma energy analysis to correlate with the isotopic distribution obtained from the scale/sludge sample. The types of data needed to characterize the 221-U Facility drain line include: a visual record for assessment of the structural integrity of the pipe and from where liquid may be draining; a scale or sludge sample to determine the isotopic distribution of radiological contaminants of potential concern (COPC) and the inventory of nonradiological COPCs; and a radiological survey of the pipe using gamma energy analysis to correlate with the isotopic distribution obtained from the scale/sludge sample. The **Drain Line Characterization Robot** was deployed to safely and economically inspect, characterize, and collect samples from 800 ft of subterranean piping in the Hanford Site's 221-U Facility. The remote capabilities of the Drain Line Characterization Robot greatly reduced radiological dose to operations personnel. No other methods to obtain similar characterization data have been identified. [Deployed in August 2000]. [Tech ID – DDFA – 2328]

Quantify Radioactive Species In Situ
The baseline procedure for analyzing high dose samples in support of characterization efforts for Decontamination and Decommissioning of Hanford's chemical processing facilities involves gross counting of

the source material, sampling, and sending it to a laboratory for analysis. Use of the **In Situ Object Counting System** (ISOCS) provides the capability for in situ analysis of radiation sources. Using the ISOCS for in situ analysis eliminates the need to take samples of high dose sources and send them to a laboratory. [Deployed in September 2000]. [Tech ID - DDFA - 2098]

Quantify Contamination in Concrete Floors
Characterization data that need to be collected from the 221-U Facility includes representative concrete core samples from the floor of each category of process cells. The **Remote Concrete Coring System** was initially deployed to collect concrete cores from cell 26 in the 221-U Facility. This deployment eliminated the need for personnel entry into the canyon process cells thereby reducing the risk to workers. [Deployed in September 2000]. [Tech ID 8096]

300 Area Soils

Soil samples contaminated with uranium were required for a laboratory study of the geochemical behavior of uranium in 300 Area site-specific soils. Samples were required from a heavily industrialized portion of the 300 Area that was crowded with underground utilities. A **"Guzzler" vacuum truck** was used to collect subsurface soil samples from areas crowded with underground utilities. Deployment of the Guzzler reduced the costs and safety hazards associated with this work. The only other alternative method of excavation, hand digging the potholes, would have increased worker exposure to contaminants, physical hazards such as falling, and the risk of adverse effects from physical activity in PPE. Requirements that would have been necessary to mitigate these risks would have made the work much costlier to perform. [Deployed in February 2001.] [Tech ID 8782]

300 Area River Corridor

Contamination Removal from the 324 Building B Cell
The Hanford 324 Building was constructed in the 1960s to support radioactive material and chemical process research and development, ranging from laboratory studies to full engineering scale pilot plant demonstrations. As a result, the facility hot cells contain highly radioactive fixed and dispersible mixed-waste contamination. The **Dispersible Removal System** in the 324 Building employs a robotic crawling vehicle with an articulated boom and interchangeable end-effectors to clean and remove these dispersible materials. It breaks up hardened materials, seizes waste fragments and vacuums dust and small size dispersibles. The system is controlled by a remote operator utilizing a console equipped with camera monitors, push buttons and joysticks. Benefits derived from this deployment are reduction in program risk by assuring critical project schedules are met and can reach difficult-to-access areas. [Deployed in September 2000]. [Tech ID 8072]